

extensive black postgenal region. The thoracic shield is correspondingly darker, especially on one specimen; and it is considerably darker than the anal shield. Head measurements of the two individuals, length: width, were 0.90: 1.03 mm. and 0.94: 1.15 mm. Abdominal crotchets varied from 38-42.

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### OBSERVATIONS ON THE VOLUNTARY DISPLAY OF COREMATA IN *ESTIGMENE ACREA*

(Lepidoptera: Arctiidae)

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The existence of coremata or "brush-organs" on the abdominal venter of many adults of Arctiidae and related families has repeatedly been demonstrated (Muller, 1874; Bethune-Baker, 1925; Chretien, 1926; Eltringham, 1934, 1935; Lane, 1957). Such organs have been noted in *Estigmene acrea* (Drury) (Morrison, 1874; Stretch, 1883; Weed, 1883; Berlese, 1909:541). The above records report results of hand manipulation of living captives or of artificial inflation of dissected organs of dead specimens; how-

ever, two of these (Morrison, 1874; Stretch, 1883) briefly mention chance observations of extrusion of coremata without artificial stimulation. I am aware of only one paper (Pagden, 1957) dealing in detail with the voluntary display of these organs. That report provides excellent photographs and discussion of this rarely observed phenomenon, in the arctiid *Cretonotus gangis* (L.) in Malaya.

During the spring of 1959 *E. acrea* appeared quite commonly at an outdoor light in Richmond, California. This incandescent light was located upon a white stucco wall exposed to the north. During the day of 28 April the temperature rose to 69 degrees F. but dropped about 10 degrees after dark owing to a brisk breeze. By 11:30 P.M. (P.D.T.) relatively few insects had responded to the light, including only one male individual of *E. acrea*. This moth was at rest upon the wall, oriented roughly toward, and 3 feet below, the light. The wings were slightly elevated and somewhat spread. The coremata were extended approximately 13 or 14 mm. and consisted of a pair of tapered, simple, yellow processes, slightly divergent and gently curved dorsally. Upon the surface of each process was a loose vestiture of long dark hair which became gathered into the form of a brush upon withdrawal of the coremata.

After the moth was first seen the coremata were held everted for about sixty seconds and then withdrawn so that only the aggregated hairs protruded from the abdomen. Within ten seconds the processes were fully re-everted for another period of approximately one minute. This procedure was repeated a total of three times. Thereafter the rhythm of the display remained as before but the organs were extended about one-half, then about one-fourth the distance of the preceding extensions. I then gently tapped the wall about six inches from the moth. The organs were immediately fully extended but for only ten seconds. Thereafter followed partial eversions of shorter duration.

During the process of eversion the abdomen was distinctly telescoped and appeared to bulge rhythmically with a peristaltic motion. When the coremata were withdrawn between periods of extension, the aggregated hairs were clearly visible in dorsal view as paired black, brush-like, structures slightly diverging and protruding about three or four mm. caudad of the abdomen.

The display was terminated when, during a period when the coremata were only slightly visible in dorsal aspect, I lightly touched the tip of an antenna of the moth. The coremata were rather quickly withdrawn, the "brushes" disappearing more slowly. The peristaltic movement of the abdomen became vigorous and continued until the brushes were no longer visible except in caudal aspect. Then the abdomen was lengthened and the wings were closed down over the body in the normal resting position.

During the entire period no other individuals of this species were seen. One hour later a female arrived but no response to or from the male, which had not moved, was detected.

The above observations differ in two particulars from those reported by Pagden for *C. gangis*. The coremata of *E. acrea* are comprised of a pair of simple processes roughly one-half the relative length of the doubly paired processes of *C. gangis* at full extension. The display of *C. gangis* was estimated to have lasted for at least half an hour and consisted of continuous extension of the coremata, while that reported here was rhythmic. Both of these features were mentioned by Morrison. The texture and general appearance of the extended coremata of *E. acrea* is much like that so clearly shown in the photographs by Pagden.

The questions concerning the meaning of this phenomenon remain, to my knowledge, unanswered. The more obvious possibilities suggested are that the display is of either a repugnant or a sexual nature, both of which are discussed by Pagden and others. On the basis of the observation reported here I can only add my support to the several objections Pagden raised concerning these two alternatives. However, other evidence presented in most previous reports on the subject (including that of Pagden) seems to me to suggest strongly that a sexual display is involved. Pagden's discussion points out that we do not understand the mechanism.

Since coremata in Arctiidae are evidently male structures their function must reflect some aspect of the male role of the organism. The most obvious, and indeed primary, male role is concerned with mating. Courtship, an integral and often highly complex aspect of this role, is frequently dependent upon a vast array of environmental factors, the limiting action of which is little understood at present. It can be emphasized that the rarely

observed voluntary display of coremata has involved only very common species, although such structures are known for many, if not most, moths of this group. This suggests that, if coremata are useful at present and are displayed by most individuals so endowed, the process occurs under relatively rigid environmental circumstances.

The few "natural" displays recorded were usually observed under semi-natural conditions at best, which is ordinarily the only way we can observe nocturnal insects. Copulating pairs of nocturnal insects are often observed, but, although I have not attempted to research this, I suspect that the details of courtship of nocturnal insects are rarely observed phenomena. I find no present evidence to indicate that the display of coremata is not of a sexual nature.

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